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# ANNUAL REPORT

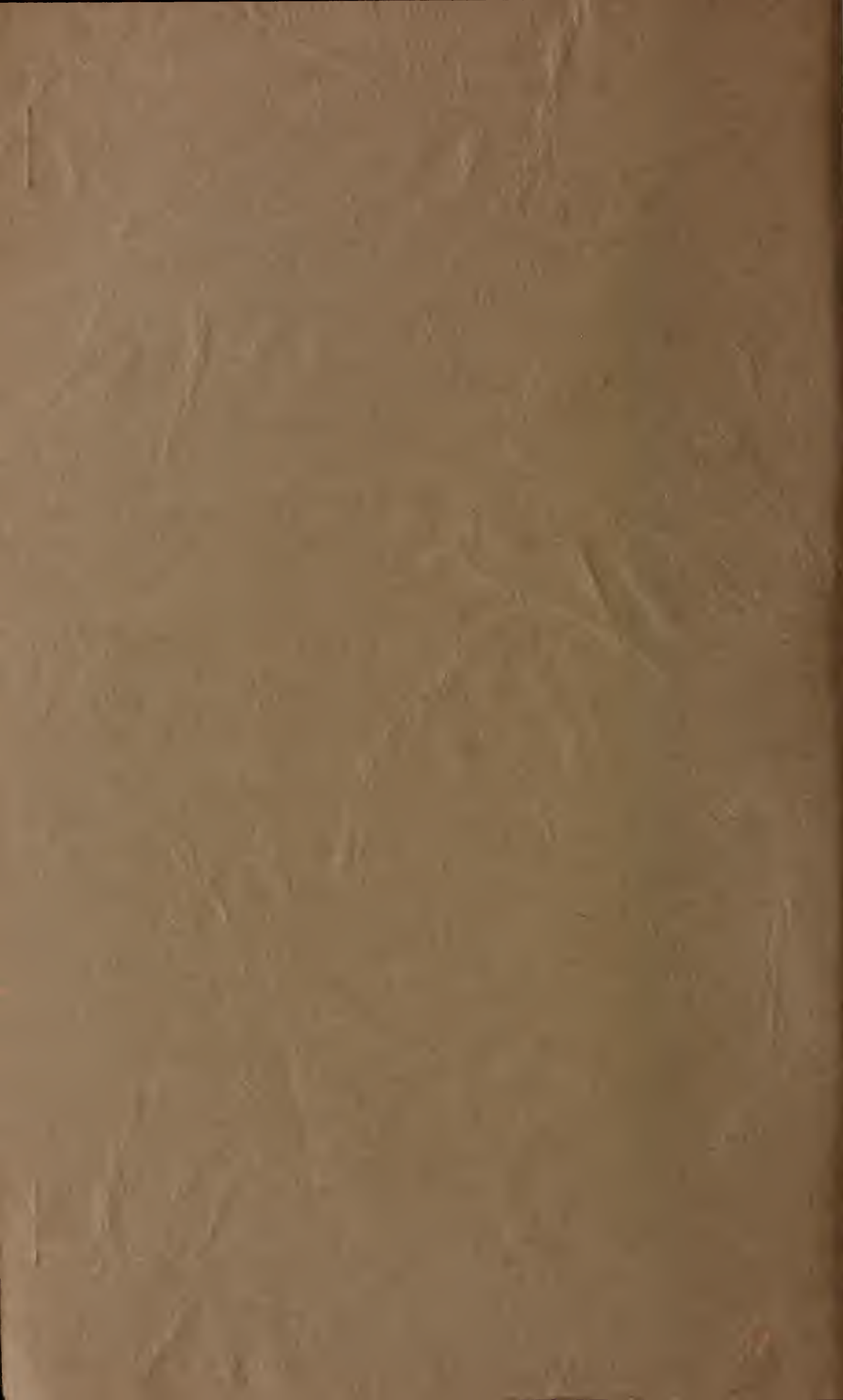
OF THE

# Canal Zone Experiment Gardens

For the Fiscal Year  
1940



THE PANAMA CANAL ZONE  
MOUNT HOME, C. Z.  
1941



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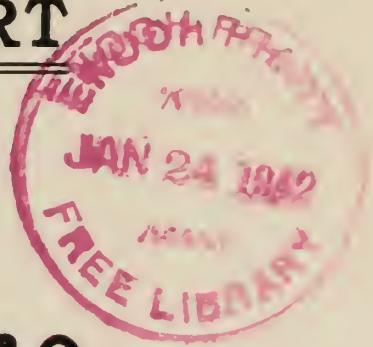
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1941





For additional copies of this publication address The Panama Canal, Washington, D. C., or Balboa Heights, Canal Zone.

## LETTER OF TRANSMITTAL

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CANAL ZONE EXPERIMENT GARDENS,  
Summit, Canal Zone, *July 9, 1940.*

SIR: I present herewith and recommend for publication a condensed report of the Canal Zone Experiment Gardens for the fiscal year ending June 30, 1940.

Respectfully,

WALTER R. LINDSAY,  
*Director.*

Mr. ROY R. WATSON,  
*Chief Quartermaster,*  
Balboa Heights, Canal Zone.

Through Mr. J. H. K. HUMPHREY,  
*First Assistant Chief Quartermaster.*



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# Annual Report

## OF THE

### CANAL ZONE EXPERIMENT GARDENS FOR 1940

By WALTER R. LINDSAY, *Director*

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#### INTRODUCTION

This fiscal year has seen great activity in the Experiment Gardens as well as in other divisions of The Panama Canal. Besides carrying on the normal operation of the Gardens with the regular experimental work and improvement projects, the Gardens were given the task of propagating a vast quantity of trees, shrubs, and grass for the new Army, Navy, and Canal Zone townsites. As the old nursery areas were inadequate to supply enough plants for even the normal planting in Panama and the Canal Zone, it was necessary to open up an additional 40 acres of land for nursery purposes. It has been a real thrill to see areas which were covered with tropical jungles six months ago turned into nice, friable, plowed land. This is the first time that any extensive plowing has ever been done in the Canal Zone with a tractor and heavy plow, and the results obtained were very gratifying. Approximately a mile and a quarter of gravel roads were made into the new areas, and plans for an extensive overhead irrigation system are being prepared.

The revival of the old Landscape Unit to do the landscape work in the new Canal Zone townsites, together with the increased nursery activity at the Gardens proper, necessitated the hiring of three new men on the gold roll, and 180 men on the silver roll.

#### PERSONNEL

On July 1, 1939, Mr. Edward T. Stanwood severed his connections with the Experiment Gardens to take charge of the Hyacinth Control work of the Dredging Division.

Mr. Paul H. Allen was transferred from the Health Department on September 21, 1939, to fill the position of Supervisor of Culture, which had been vacant for three years. Mr. Allen is responsible for the general care of the Gardens, including the care of grounds, nurseries, and the Balboa Orchid Gardens. Besides being a trained botanist, Mr. Allen received valuable experience and a thorough knowledge of plants while working for the Missouri Botanical Gardens in St. Louis, and managing their station in Balboa.

Mr. Norman R. Kearns was employed on February 12, 1940 as foreman of the new project for raising plants for the new Army development program. Mr. Kearns' past experience in general farming and greenhouse management in the United States, is valuable in his present position.

On May 1, 1940, Mr. Stanley J. Tureski was transferred to the Gardens from the rolls of the Balboa District Quartermaster when all new landscape work was delegated to the Gardens forces. Mr. Tureski is foreman in charge of the execution of the new plantings in the different districts on the Pacific side of the Isthmus. This work fits in well with his former training and experience while studying forestry at Purdue University. He worked on the Purdue campus after graduation, and for two years previous to this he spent all of his spare time working in the University Nursery. While attending high school and during his first two years at the University, he worked on a golf course, and did landscape work.

Mr. Robert E. Thompson was employed on a temporary basis on June 22, 1940, to supervise the landscape work on the Atlantic side of the Isthmus.

Mr. Gilbert Smith was engaged temporarily to assist in carrying on the nursery work at the Gardens during the absence, on leave, of Mr. Allen.

The Gardens silver force was increased from 30 men on July 1, 1939, to 200 men on June 30, 1940; the increase being made necessary due to the large nursery expansion program and added landscape work in the new townsites.

## NURSERY OPERATIONS

By PAUL H. ALLEN

The normal function of the nursery unit has been the production of plants for the renewal of such plantings about the Zone as had become obsolete or unsightly, the growing of seed and plant accessions for experimental purposes, and the dissemination of plants into private hands. The present expansion program of The Panama Canal, embodying the construction of entire new townsites, will naturally affect vitally the routine work of our nurseries. On the expectation of supplying planting material for the landscaping of these townsites, the present nursery areas have already been expanded about 40 percent. It is expected that it will be necessary to increase these plantings to at least double those of normal times.

In the propagation of the plants to be used, every effort is being made to cooperate with the landscape unit in the production of plant material



of the highest type, with the continued view of making the Canal Zone a demonstration area of the most desirable kinds of tropical horticultural material. Although the average employee takes little account of the landscape material used about his quarters, the minimum expectation is green grass and shade, as has been amply demonstrated by the discontent among new employees put hurriedly into quarters in dusty and treeless areas. It is our belief that the average person unconsciously absorbs a great deal of his content or dislike of a location from the surrounding landscape plantings. With this in view, as well as the hope of making the Canal Zone one of the tropic garden spots of the world, the present work is carried on.

The Canal Zone Experiment Gardens are unusually fortunate in being able to select from the many accessions of plant material received for experimental plantings, many things of ornamental nature suited for landscape work. The following is a list of plant accessions received within the fiscal year, showing the countries or origin:

Country	Packets of seed	Plants
Argentina	51	
Australia	4	
Belgian Congo	2	
Brazil	1	
Colombia	6	
Cuba	8	
Equador	2	10
Guatemala	2	
Hawaii	9	
India	12	
Mexico	1	
New Caledonia	1	
Puerto Rico	1	
Singapore, Straits Settlements	18	
Tahiti, Society Islands	1	164
Tanganyika Territory, British East Africa	17	
United States	48	1,398
Venezuela	3	
Local Sources	180	136

Probably the finest single shipment of plant material received during the year was that sent by Mr. Harrison W. Smith of Papeete, Tahiti, Society Islands. Included in the shipment were new and outstanding species of Bamboo suitable for Zone planting, various ornamentals, and most particularly, 44 plants of the famous "Durian," *Durio zibethinus*. This Malayan fruit has acquired an almost fabulous aura of legend about the very name, but is extremely rare outside of the East Indies. Alfred Russell Wallace, in his "Malay Archipelago," thus describes the tree: "The Durian grows on a large and lofty forest tree,

somewhat resembling an elm in general character, but with a more smooth and scaly bark. The fruit is round or slightly oval, about the size of a large coconut, of a green color, and covered all over with short, stout, spines, the bases of which touch each other, and are consequently somewhat hexagonal, while the points are very strong and sharp. It is so completely armed that if the stalk is broken off it is a difficult matter to lift one from the ground. The outer rind is so thick and tough, that from whatever height it may fall it is never broken. From the base to the apex five very faint lines may be traced, over which the spines arch a little; these being the sutures of the carpels and show where the fruit may be divided with a sharp knife and a strong hand. The five cells are satiny-white within, and are filled with an oval mass of cream-colored pulp, imbedded in which are two or three seeds about the size of chestnuts. This pulp is the eatable part, and its consistence and flavor are indescribable. A rich butter-like custard highly flavored with almonds gives the best general idea of it, but intermingled with it come wafts of flavor that call to mind creamcheese, onion sauce, brown sherry, and other incongruities. Then there is a rich glutinous smoothness in the pulp which nothing else possesses, but which adds to its delicacy. It is neither acid, nor sweet, nor juicy, yet one feels the want of none of these qualities, for it is perfect as it is. In fact to eat Durians is a new sensation, worth a voyage to the East to experience."

Wallace continues at some length to describe the fly in the ointment of all this perfection, which is the perfectly overpowering smell which the fruit possesses when fully ripe. It has been described as being like a dog three days drowned, or more delicately, as a mixture of rich cheeses and onions. In any event, if the prospective consumer can overcome his qualms to the extent of taking the first bite, seemingly all else is forgotten, and Dutch planters in Sumatra forego home leave rather than miss the Durian season. Whether this fruit ever becomes popular in the Zone is a rather moot question, but it has already shown that it is entirely at home in our climate. It has been demonstrated in the East Indies that it is capable of being budded, and that there are varieties having all of the delicious flavor, and less of the smell than the average. It is hoped that some of our present stock of trees prove to be of this relatively scentless variety.

Included in the same shipment were several plants of *Clerodendron paniculatum*, two of which survived, and are at the present time in full flower in the grounds. This plant has the attractive quality of being constantly in flower, bearing 24-inch scarlet pagodas of bloom atop stout, shrubby, canes. Fortunately, it has proven quite easy of propa-





PLATE I



*Chalcas exotica*—Specimen planting



gation, and is at the present time being grown on in some quantity for further plantings.

Of local accessions, one of the finest has been the acquisition of a lot of seed of the native tree called "Indio" by the Panamanians. This tree seems to be *Schyzolobium parahybum*, native also to Costa Rica, and is one of the finest and showiest of the native Panama trees. It lasts well in bloom, and has the added attractiveness of being handsome, both as a mature tree, and as a juvenile specimen. Young trees greatly resemble tree ferns, with very graceful pinnate foliage.

Until the beginning of the past fiscal year, all of the nursery stock had been grown either in metal cans, or in the usual nursery beds. An experimental plot of about a quarter of an acre was thoroughly plowed, and planted in rows to specimen plants of Chalcas exotica, and various species of palms. (See Plate I.) This plot has grown almost uniformly well, and seems to indicate that on lighter types of soil there may be possibilities in the way of growing large-sized specimen plants. Another area of slightly more than an acre is at present being planted in the same way for further test.

Nursery stock distributed during the past year has been as follows:

#### *Local Sales*

Fruit trees.....	1,647
Ornamental plants.....	7,315
Propagating material; soil, fruit, etc.....	7,924
Rubber seeds.....	524,290
Java grass.....	2,720 bags
Mangosteen fruits.....	1,762

#### *Plants used in the different Canal Zone Townsites*

Palms.....	390
Shrubs.....	3,103
Trees.....	124
Ferns, border plants, etc.....	1,196

### *Foreign Sales*

	Fruit trees	Orna- mental plants	Cuttings	Seed packets
Colombia.....	1,876	193	75	1
Curacao.....	49	44		
Equador.....	252			
Puerto Rico.....	3	49		6
Venezuela.....	78	37		1
Costa Rica.....		8		
California.....		32		12
Cuba.....		34		6
Florida.....			18	32
Brazil.....				6
British Guiana.....				1
Bermuda.....				1
Dominica.....				1
Australia.....				2
Martinique.....				1
Hawaii.....				15
Straits Settlements.....				5
Seychelles.....				2
Egypt.....				1
Guatemala.....				1
Java.....				1
Tahiti.....				1
Tanganyika.....				2
New York.....				1
Russia.....				1

### ARMY PROJECT

By PAUL H. ALLEN and NORMAN R. KEARNS

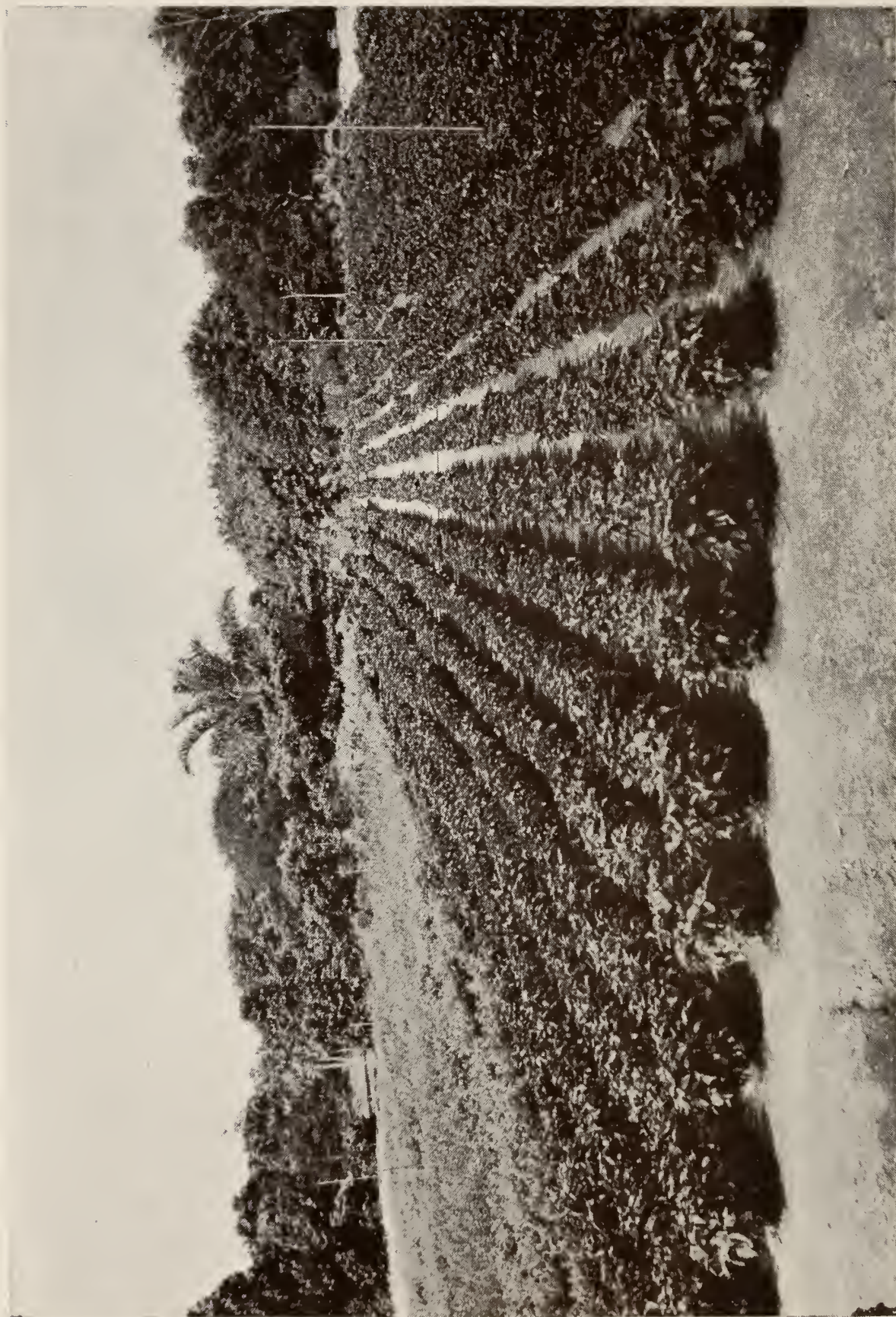
The present expansion program being carried out in all branches of the Government service on the Canal Zone has oftentimes had unexpected and sometimes startling repercussions in distant and entirely unrelated branches of the organization. In our own case, this has been true in the seemingly far-distant field of the development of the new units by the United States Army, for the defense of the Canal. Flying fields, hospitals, and gun emplacements would seemingly be far from the realm of horticulture, but when it is considered that the living quarters for both officers and men must have at least the minimum requirements in the way of shade trees, screening shrubbery, grass for public areas, and parade grounds, as well as vines and tropical foliage suited to the concealment of objects of military importance, it is seen that a horticultural problem of major proportions is indicated.

In January of the present year, plans were drawn up with the Construction Quartermaster, Panama Canal Department, U. S. A., for the production, by the Gardens, of all landscape material to be used on the Isthmus; for the planting of new Army projects, as outlined. So vast





PLATE II



*Acalypha* and *Lagerstroemia indica*—Nursery rows being grown at the Canal Zone Experiment Gardens for the  
United States Army Landscape Program, October 1940.



were the developments that it became evident immediately that normal nursery areas used by the Gardens would be entirely inadequate. For this reason, as well as to avoid confusion with nursery areas used for the landscaping of areas housing personnel employed by the departments of The Panama Canal, it was thought best to attempt the production of the required amount of material on grounds to be developed specifically for that purpose. (See Plate II.)

In February 1940, an order was placed by the Army with the office of the Chief Quartermaster, providing funds for the development of approximately 40 acres of newly cleared land, and the production of more than 450,000 plants, of all types, for the completion of the landscape program.

Land immediately adjacent to our present grounds was selected and the heavy timber and guinea grass was cleared by gangs of machete and axe men. As is customary in Central America, most of this cut-over area was burned when properly dry, and the remaining stumps and logs removed with the aid of a tractor. Considerable discussion is heard pro and con as to the practicability of plowing in the tropics, especially on heavy clay land. Since an ideal opportunity was presented by the dryness of the season (April being the height of the dry season in Panama), plowing with a tractor and disk plow was attempted and found entirely successful over the whole area, thus saving an incalculable amount of hand labor.

New roads, totaling slightly more than  $1\frac{1}{4}$  miles, were surveyed, with the view of making all parts of the new development easily accessible by truck. The construction of these roads was greatly complicated by our inability (caused by unusually heavy work programs in other departments of the Canal organization) to have truck service during daylight hours. It was found necessary to attempt the entire road building program at night, that being absolutely the only time that the trucks needed for hauling gravel could be had. Fortunately, nearly all of the work of lining out the roadbeds, and grading, could be done during daylight hours, necessitating only the actual dumping of the gravel after dark.

Adjoining the jungle area cleared, land formerly occupied by the Canal Zone Poultry Farm, was taken over. In this area were the old foundations of chicken sheds, most of which, while overgrown, were in reasonably good condition, and partially equipped with water systems. The platforms formed by these foundations have been used as seed propagating plots, and for the setting out of plants potted in metal containers. Several sheds and out-buildings, although badly damaged

by termites, were still standing and have been used for storage of potting soil, metal plant containers, and machinery. The largest building on the grounds, formerly used as a barn, was in an unusually dilapidated condition, and has been demolished. Another building of more practical design for our present purposes has been reconstructed by the office of the Building Division, on the same site. (See Plate III.) This new structure has storage space for the tractor, plant containers, an office for the foreman in charge of the development, and a potting room.

Since the propagation of so much plant material came as a complete surprise, the Gardens were taxed to the utmost to provide propagating material to meet such heavy demands. The Gardens' collection of plants is, fortunately, a large and comprehensive one, providing most of the novelties for planting as specimens, as well as the major portion of rooting material. In spite of our large collections, shortages were encountered in certain species. A cash fund has been established for the purchase of propagating material from local sources, as well as containers for the potting of plants.

One of the major problems presented by the new program has been in the production of grass suitable for parade grounds, and for the lawns of living quarters and barracks. This seemingly is in direct contradiction to the fact that "Grass," as such, is usually only too easy to grow and too painfully laborious to get rid of under tropical conditions. The only species of grass which seems to answer all requirements of ease of propagation in large quantities, and desirability for the types of areas outlined, is the "Java" grass, *Polytrias praemorsa*. This grass is of the stoloniferous type, such as are also the "Bermuda," and the "Washington Bent" grasses, used in other parts of the world. The practice, until the present growing season, had been to plant stolons of the grass and, after adequate coverage had been attained by the liberal use of fertilizer, to cut further stolons with a machete, a practice disastrous to any further cropping of that area for that season, since almost all of the roots would be removed, leaving relatively weak whisps to reestablish the area. Under that method of cropping, an enormous territory would have been necessary for the establishment of sufficient grass to fill the needs of the Army program. A new method of cutting grass is at present being tried out. The system is the cutting of the stolons by a machine of the sickel-bar mower type, the result being that all the grass roots are left to reestablish the plant. This growth has been astonishingly rapid, and it has been found that, instead of one or two cuttings per year from a given area, grass may be cut as often as every ten days, under favorable circumstances, producing very nearly as much grass per cutting as under the former method.



PLATE III



New barn under construction



The following table shows the estimated number of plants which will be required for the two-year program of landscaping the new Army projects, together with an inventory as of July 1, 1940, showing the plants already established in our new nurseries:

Species	No. required	No. propagated to July 1, 1940
<i>Acacia auriculaeformis</i> .....	200	102
<i>Acalypha wilkesiana</i> .....	18,230	5,177
<i>Acanthorhiza warscewiczii</i> .....	280	75
<i>Achras sapota</i> .....	100	216
<i>Actinophleous macarthurii</i> .....	490	-----
<i>Actinophleous sanderiana</i> .....	500	-----
<i>Actinorhysis calapparia</i> .....	100	10
<i>Adenanthera pavonina</i> .....	200	314
<i>Adhatoda</i> sp.....	2,130	604
<i>Adonia merrilli</i> .....	510	200
<i>Allamanda cathartica</i> .....	1,350	-----
<i>Albizia lebbek</i> .....	150	150
<i>Alocasia</i> sp.....	6,000	-----
<i>Amomum hemisphericum</i> .....	3,250	-----
<i>Amomum magnificum</i> .....	3,250	-----
<i>Anacardium excelsum</i> .....	220	384
<i>Andira inermis</i> .....	100	-----
<i>Antigonon leptopus</i> .....	500	544
<i>Antidesma bunius</i> .....	350	-----
<i>Ardisia humilis</i> .....	9,490	2,764
<i>Areca alicae</i> .....	800	1,380
<i>Areca catechu</i> .....	690	96
<i>Barleria involucrata</i> .....	23,810	-----
<i>Bentinckia nicobarica</i> .....	940	1,645
<i>Bougainvillea glabra</i> .....	10,000	-----
<i>Brownea macrophylla</i> .....	250	-----
<i>Caesalpinia pulcherrima</i> .....	2,630	3,500
<i>Caladium bicolor</i> vars.....	6,120	-----
<i>Calocarpum mamosum</i> .....	100	-----
<i>Calophyllum calaba</i> .....	280	282
<i>Calyculophyllum candidissimum</i> .....	260	-----
<i>Canarium odoratum</i> .....	600	-----
<i>Canarium commune</i> .....	460	324
<i>Caryota mitis</i> .....	220	-----
<i>Casuarina equisetifolia</i> .....	500	540
<i>Cassia fistula</i> .....	960	1,840
<i>Cassia grandis</i> .....	100	-----
<i>Cassia moschata</i> .....	200	-----
<i>Cassia multijuga</i> .....	500	500
<i>Cassia nodosa</i> .....	930	1,027
<i>Cestrum diurnum</i> .....	150	-----
<i>Cestrum nocturnum</i> .....	1,100	365
<i>Chalcas exotica</i> .....	33,185	-----
<i>Chamadorea wendlandiana</i> .....	360	-----
<i>Chrysalidocarpus lutescens</i> .....	2,630	-----
<i>Chrysalidocarpus madagascariensis</i> .....	800	-----
<i>Citrus aurantifolia</i> .....	490	-----
<i>Citrus limonia</i> .....	260	-----
<i>Citrus paradisi</i> .....	690	-----
<i>Citrus sinensis</i> .....	1,060	-----
<i>Cocos nucifera</i> .....	530	600
<i>Cocos plumosus</i> .....	1,250	-----

Species	No. required	No. propagated to July 1, 1940
Cocoloba uvifera	390	
Codiaeum sp.	35,460	21,004
Congea tomentosa	1,000	
Crinum longiflorum	250	
Cryptostegia madagascariensis	1,600	2,000
Cycas circinalis	500	
Delonix regia	520	750
Dieffenbachia picta	500	
Duranta plumerei	21,160	15,568
Elaeis guineensis	200	
Enterelobium cyclocarpum	200	61
Eranthemum sp.	3,800	
Erenoglythis major	90	
Eugenia dombeyi	160	
Eugenia malaccensis	510	
Euphorbia pulcherrima	5,000	
Ficus retusa	700	50
Ficus waringiana	960	50
Flacourtia ramontchii	492	34
Galphemia glauca	9,350	
Garcinia mangostana	390	
Garcinia tinctoria	300	140
Gardenia jasminoides	3,000	
Harpulia cupanoides	200	72
Hedychium coronarium	11,660	
Hibiscus hybrids	21,000	1,984
Hippeastrum equestre	1,500	1,500
Holmskioldia sanguinea	1,000	
Honckenia ficifolia	3,000	327
Hymenocallis littoralis	1,500	557
Isertia haenkeana	2,700	
Ixora coccinea	29,100	
Jacobinia coccinea	200	
Jasminum pubescens	500	
Jasminum sp.	24,260	
Kigelia pinnata	100	
Lagerstroemia flos-regina	1,040	260
Lagerstroemia indica	2,310	3,500
Licuala grandis	200	
Licuala spinosa	1,000	
Livistona chinensis	455	
Livistona hoogendorphii	450	
Mangifera indica	810	
Mimusops elengi	430	
Myrciaria cauliflora	75	
Nephrolepis exaltata vars.	40,000	26,509
Nerium oleander	1,210	
Oenocarpus panamensis	1,000	90
Ormosia coccinea	300	
Pachira aquatica	350	500
Pandanus tectorius	270	275
Persea americana	360	
Petrea volubilis	600	
Phoenix roebelinii	420	
Plumeria hybrids	620	
Pogonopus speciosus	430	
Posoqueria latifolia	700	59
Ptychoraphis augusta	810	
Quisqualis indica	250	



Species	No. required	No. propagated to July 1, 1940
Roystonea oleracea	2,000	
Sabal sp.	390	300
Samanea saman	490	
Sansevieria zeylanica	1,000	
Scheelea zonensis	200	
Schinus terebinthifolius	200	
Schizolobium parahybum	1,000	
Seaforthia elegans	440	
Spathodea campanulata	530	1,607
Styloma pacifica	385	500
Swietenia macrophylla	810	170
Tabebuia guayacan	250	
Tabebuia pentaphylla	250	225
Tabernaemontana coronaria	5,230	
Tecoma stans	580	375
Tectona grandis	200	
Terminalia catappa	210	56
Terminalia edulis	300	324
Terminalia myriocarpa	250	
Thevetia nerifolia	390	
Thumbergia erecta	11,180	
Thumbergia fragrans	1,000	912
Thumbergia grandiflora	1,000	
Triplaris americana	550	
Vinca rosea	8,830	
Warscewiczia coccinea	450	
Wormia burbridgei	110	

A considerably greater portion of the plants than those shown by this list have actually been propagated, but are too small to be planted in the field, or potted, and have not been included in this list. Since it is not definitely known at this time if propagating material will be available of all species listed, it has been thought advisable to accumulate some surplus of other species to offset this possibility.

### LANDSCAPE WORK

By J. P. KEENAN

During the past fiscal year the activities of all Departments and Divisions of The Panama Canal have increased to a point unparalleled since the construction of the Canal. These increased activities naturally mean a corresponding increase in the personnel and housing facilities. Today a large building construction program is under way, involving expansion in each of the present Zone townsites, as well as the construction of new ones. The regular quarters replacement program has continued with the construction of new quarters on both sides of the Isthmus. In accordance with the landscape policy of The Panama Canal, the landscape planning has continued apace with the construction program.

In addition to The Panama Canal work, the United States Army has inaugurated a large construction program involving the expansion of most of the existing Army posts, as well as the establishment of new ones. In connection with this Army building program, the Experiment Gardens has been authorized to develop landscape plans and to supervise the actual planting work.

During the past planting season from July 1 to October 30, 1939, the actual planting work executed was relatively small in comparison with previous years. Most of this work was confined to a replanting program in Balboa and Cristobal, and the completion of new work started before July 1, 1939. The landscape work completed during this period is as follows:

1. The completion of the planting of the Balboa Prado.
2. The landscape planting of four type 201 quarters, Frangipani Street, Ancon.
3. The planting of the Silver Bachelor Quarters, La Boca.
4. Palm tree planting along 6th, 7th, and 8th Streets, New Cristobal. The labor for this work was furnished by the District Quartermasters in the districts involved.

Aside from the landscape plantings described above, the landscape efforts for a major portion of the year were confined to the preparation of landscape plans and the coordination of plans for the handling of the landscape program which began during the later portion of the fiscal year. Estimates were submitted for the landscape work on the various projects. Plant estimates were also derived so that the Nursery Unit of the Gardens would be able to furnish ample well-established plants, as they are needed for each job.

The actual work on The Panama Canal landscape program was started early in March. This work was carried on by a special landscape gang in the forces of the District Quartermaster at Balboa Heights, under the supervision of Mr. Stanley J. Tureski, landscape foreman, who was hired for this purpose. The early stages of this work were confined to the finish grading and top dressing of the new Diablo townsite.

Effective May 1, 1940, the Chief Quartermaster approved the reestablishment of the Landscape unit to take over all landscape work in connection with the new construction program. Through this authorization, the special landscape gang was transferred from the District Quartermaster at Balboa Heights to the Experiment Gardens. This change should greatly increase the efficiency of the handling of the landscape work, as by this arrangement the working forces and the supervision are in one unit. The planning of the work is also greatly



simplified inasmuch as no other organization must be considered in the compiling of these plans.

The Assistant Director-Landscape Architect continued to work with the various District Quartermasters on the numerous landscape problems, rendering assistance as these problems presented themselves. One hundred and twenty-three tree removal inspections were made in the various Quartermaster districts during the fiscal year. Recommendations concerning them were forwarded to the First Assistant Chief Quartermaster.

Landscape advice and assistance was rendered to a number of individuals and organizations outside of The Panama Canal. The Navy Submarine Base at Coco Solo was assisted in the arrangement of a landscape planting program for their new expansion. The Army Aircraft Defense units also requested assistance in arranging plantings around their anti-aircraft batteries, listening posts, and searchlight units, for the purpose of camouflage. This work was exceptionally interesting as this was an entirely different and new landscape planting approach for this organization.

The Landscape Unit of the Gardens is willing and ready to advise whenever called upon. We feel that such extension work is an important phase of our activities. Through this work we hope to be able to establish a congruent type of planting practice, as well as to disseminate throughout this region the many attractive plants which have been imported from other parts of the tropical world.

### BALBOA ORCHID GARDEN

By PAUL H. ALLEN

Activities at the Balboa Orchid Garden have been confined to routine maintenance work, and some emergency construction. Under the former heading comes the eternal and unremitting fight against grass, the potting of orchids, sweeping of leaves and trash, and such usual matters necessary for the tidy appearance of the grounds.

At the head of the list of construction work may be listed the final completion of the pergola, briefly described, in the process of construction, on page 14 of the 1939 Annual Report. On the suggestion of the Director, the original plan of the pergola floor was changed, allowing quarter-round corner beds for the cultivation of shade-loving plants. Chief among these have been a dozen native tree ferns obtained in the interior of Panama during August of 1939. These plants have become well established, and are supplemented by various species of decorative foliaged *Aeroids*, *Pilea*, *Alpinia*, *Sellaginella*, *Tradescantia*,

etc., which have completed the picture of tropical luxuriance now existing. A concrete floor of flag stones, cast to resemble cut stone, was completed, covering the entire pergola floor not occupied by the plant beds and the central pool. Two concrete benches of pleasing design, suitable to the location, were cast, and have been greatly appreciated by visitors to the grounds.

The only approach to the pergola has been by a narrow, and often-times muddy path crossing a small stone bridge. The path on the far side of the bridge connecting with the pergola has been completed with concrete flag stones during the fiscal year, as well as the addition of a flight of stone stairs leading to a terraced path much used by visitors. This path and earthen stairs previously existing were often in a slippery and potentially dangerous condition, and it is felt that the present improvements will be of considerable aid to visitors. The central walk through the grounds has been extended through the area back of house 890 Morgan Avenue, to a point directly opposite the Balboa High School building. The Orchid Garden grounds have in the past been in an unfortunately secluded position, offering considerable difficulties of encounter to persons unfamiliar with their location. It is hoped that the extension of the walk, supplemented by suitable landscaping, will entirely remedy this situation.

During December 1939, considerable increase was made in the existing water system in adding lateral lines totaling over a thousand feet. The object of these extensions was the establishment of standpipes from which permanent sprinkler heads could operate and supply water to newly planted areas. In spite of the greatly curtailed water supply during the past dry season, plantings at the Orchid Garden suffered little, due to the new connections being close at hand for watering of the smaller and rarer specimens.

A small wooden potting shed fell into such a dangerous state of disrepair, due to termite damage, that it was thought best to remove it in the interest of public safety. Since it comprised one of the necessary units of the grounds, it has been reconstructed in a new and more suitable location, as a lean-to shed fronting an existing storage house. The construction has been of field stone, plastered, with screened windows, and a galvanized iron roof. Two work benches and a tool cabinet have been added, which have been a great convenience. The present arrangement makes a much more compact unit for necessary repair and potting work, removing such structures from the garden grounds usually seen by visitors.

Numbers of undesirable native species of trees have been removed, and their places taken with plantings of ornamental species of palms.



Over fifty species new to the grounds, some of them unique in Isthmian horticulture, have been established within the past year. Of the collection, probably the most notable is the "Talipot," *Corypha umbraculifera*, which comes from the island of Ceylon, and the south of India.

This noble palm has been associated with mankind from earliest history, the giant folded fronds being carried before tribal chiefs in Ceylon as a mark of rank. The earliest manuscripts of the Vedas were written with a metal stylus on the narrow strips between the leaf ribs, making long, narrow "books." The aspect of the plant is in every sense noble, well-warranting the title of "Princes of the Vegetable Kingdom," applied to all palms by Linneas. In Jamaica, where our plants were obtained, the plant is commonly known as the Century Palm, since it blooms but once, at the close of a long lifetime. This period may actually vary from thirty-five to perhaps eighty years, depending in growing conditions. The flowering clusters, when produced amid the crown of giant leaves, assume monster proportions, topping the shafted trunk with a thirty-foot plume of thousands of flowers. Once the seed is matured, the entire plant dies. In its flowering or fruiting stage, it is probably one of the most impressive sights to be met with in the tropics. It is hoped that the plants established on the grounds will thrive, to provide interest to a future generation of Canal Zone residents.

One new bench (constructed with concrete ends, renewable wooden seat and back) for the convenience of the public, was installed near the Garden entrance.

New flowering and foliage plants of especial interest are *Strobilanthus dyerianus*, a shade-loving shrub of small stature, having attractively marked grey and purple leaves; *Jacobinia coccinia*, a small shrub bearing showy inflorescences of scarlet flowers; and an especially fine new *Ixora* (*Ixora incarnata*), with bright pink heads of flowers eight inches in diameter. A single tree of the exceedingly rare *Amherstia nobilis* was planted, and is thriving, although it has not as yet flowered. It is hoped that propagating material may be taken from all of the above within the coming year, as permanent additions to Canal Zone landscape plantings.

As usual, numerous showings of flowering plants of various kinds were publicized, all of which were well-attended both by people from the Canal Zone, and Panama. Of especial interest were the usual yearly shows of the Orchid hedge, made up of species of the Genus *Sobralia* (*Sobralia panamensis*, and *Sobralia leucoxantha*). These orchids bloom several times during the months of September, October, and November, opening, on each occasion, well over a thousand blooms. Also during September are to be seen hundreds of plants in full flower of the native

*Cattleya* (*Cattleya deckeri*), bearing from six to eighteen flowers on each flowering stem. A similar species, *Cattleya skinneri*, native of Costa Rica, blooms in like quantity in March, providing a very impressive showing. Most of these plants, when in bloom this year, were carried to the Gamboa Flower Show, making a beautiful picture.

Of other new and interesting orchids, the Philippine Moth Orchids (*Phalaenopsis*) deserve especial mention. A very fair collection of these rare plants has been built up bit by bit, and have been in flower a great deal of the time during the entire year. *Phalaenopsis amabilis* and *Phalaenopsis rosea* have flowered almost constantly, and have been supplemented by *Phalaenopsis sanderiana*, *Phalaenopsis stuartiana*, and numerous hybrids. Although of great rarity, these plants, when once established, thrive wonderfully well in the Canal Zone climate, and offer some of the most delicately beautiful blooms to be found in the entire Orchidaceae.

Several showings were had of the Night Blooming Cereus, which have been established near the foot of the stairs leading to the Administration Building. These plants have thrived wonderfully, with frequent applications of manure, and the installation of an automatic watering system. The largest showing of blooms displayed well over two thousand flowers, and attracted crowds.

#### SUGAR CANE

The Canal Zone Experiment Gardens has played an important part in reestablishing the sugar cane industry of Panama. "Mosaic" disease was rapidly destroying the sugar plantations, which were chiefly planted to the variety "Caña Blanca." The Gardens introduced a great many varieties of cane from the United States Department of Agriculture, as well as from Hawaii and Puerto Rico. These varieties were propagated and disseminated as rapidly as possible, with the result that many of the sugar plantations in Panama are now growing nothing but disease-resistant varieties of cane.

As our project of introducing, multiplying, and disseminating disease-resistant varieties of cane is practically complete, we have reduced our collection to the following five varieties: P. O. J. 2714, 2727, and 2878; Mayaguez 42 and 63. These varieties are practically immune to "Mosaic" disease, are high in sugar content, and grow luxuriantly in this region.

By destroying all but the disease-resistant varieties of cane, we are endeavoring to protect the large collection of sugar cane varieties which are being grown and tested at the Canal Zone Experiment Gardens by the United States Department of Agriculture. Many of the varieties



in their collection are susceptible to "Mosaic" disease, but due to other desirable characteristics, are valuable for breeding work, and must be protected, if possible.

### CINCHONA

The outstanding introduction of the year was that of 200,000 *Cinchona ledgeriana* seeds from Merck and Company, Rahway, New Jersey.

At the present time, Java produces 95 percent of the world's supply of quinine. By regulating the output of bark, the Dutch are able to maintain a relatively high price for quinine sulphate in foreign markets.

The first attempts at cultivating Cinchona in Java were made in 1852, but these were not a commercial success because the species grown gave such a low yield of alkaloides. In 1865, however, this industry was established on a firm basis following the introduction of a variety of Cinchona (*Cinchona ledgeriana*) very rich in quinine, which was secured in South America.

The phenomenal success of the Cinchona industry in Java is due chiefly to:

- (a) Excellent agricultural methods.
- (b) Suitable soil, elevation, temperature, and rainfall.
- (c) A plentiful supply of cheap labor.
- (d) Careful selection and propagation of desirable strains of Cinchona, more particularly those of *Cinchona ledgeriana*.
- (e) The regulation in recent years of market prices for the bark by agreement between growers and manufacturers.
- (f) The valuable experimental and other work, extending over many years, of the Government Cinchona plantations.

Due to unrest in the world today, it is even more desirable that we should have a source of supply of quinine nearer home. For this reason, attempts have been made within recent years, to establish experimental planting of Cinchona in Central and South America, Porto Rico, and Cuba. South America is the home of Cinchona, thus it seems logical to suppose that quinine could be produced in commercial quantities in this hemisphere, providing that high-yielding varieties are grown to offset the higher cost of labor.

As the effect of elevation on the percentage of quinine in the bark of Cinchona trees is perceptible below 3,200 feet, and above 7,000, and is negligible between 3,000 and 6,000 feet, where other conditions are equal, most of the seeds which we received this year were distributed among growers in the Boquete and Volcan regions of Chiriqui Province of Panama, at elevations ranging from 3,500 to 6,200 feet. A few thousand seeds were retained for trial in El Valle, at elevations ranging

from 2,000 to 3,000 feet, as the trees are reported to grow and fruit more rapidly at low elevations, and we are desirous of getting more propagating material as soon as possible. It will also be possible for us to inspect the trees more often at El Valle than those in the more remote Province of Chiriqui.

#### SWINGLEA GLUTINOSA AS A CITRUS STOCK

The citrus relative *Swinglea glutinosa* has been reported to be a superior stock upon which to bud or graft citrus. The tree is extremely luxuriant in growth, and citrus trees on Swinglea root stock are reported to outlive those grown on the standard sour orange stock.

Experiments carried on at the Canal Zone Experiment Gardens during the past three years would indicate that certain species and varieties of citrus will do better on Swinglea stock than others will. The following tables give the varieties and the number of trees that became established on a corresponding number of Swinglea and sour orange seedlings:

TABLE I  
SWINGLEA STOCK

Variety	Number of trees budded	Number growing	Percent- age of takes
Tahiti Lime.....	20	11	55
Rangpur Lime.....	25	11	44
Eureka Lemon.....	10	4	40
Temple Orange.....	25	12	48

TABLE II  
SOUR ORANGE STOCK

Variety	Number of trees budded	Number growing	Percent- age of takes
Tahiti Lime.....	16	14	87½
Rangpur Lime.....	18	15	83½
Uureka Lemon.....	10	8	80
Temple Orange.....	20	18	90

Although a fair percentage of some of the varieties of citrus grew, the average plants were not as large and robust at the end of the second year as the same varieties of citrus grown on the standard sour orange stock. There would thus be no advantage in using *Swinglea glutinosa* as a citrus root stock, unless the life of the trees was extended, or it proved to be more resistant than the sour orange stock to certain citrus root disease.





PLATE IV



Citrus budded on *Swinglea glutinosa* root-stock

One of the chief drawbacks to the Swinglea stock is the thick bark, which rapidly heals over the inserted bud. (See Plate IV.) This may be overcome by using cions instead of buds. Another poor feature about the Swinglea stock is that it suckers too freely. When the plants are cut back to force strength into growing buds, many suckers immediately appear below the union of the bud.

#### PUERTO RICO SWEET CORN

A sample package of tropical Sweet Corn produced by the United States Department of Agriculture Experimental Station at Mayaguez was received by the Gardens in August 1939. Shortly after the seeds were planted we had six weeks of almost continuously cloudy and rainy weather. The seeds germinated one hundred percent, but the growth of the young plants was severely checked by a combination of aphids and too much rain. The aphids had already done their damage before it was dry enough to spray effectively for them. The whole crop was destroyed.

#### PAPER ON MANGOSTEEN CULTIVATION

The Canal Zone Experiment Gardens were highly honored at being asked to send a representative to present a paper on Mangosteen cultivation to the Eighth American Scientific Congress, which was held in Washington, D. C. on April 10th to 18th, 1940. Although it was not possible to send a representative to the Congress, the following paper was presented and read on April 16th:

#### MANGOSTEEN CULTIVATION

By WALTER R. LINDSAY

The Mangosteen *Garcinia mangostana*, native of the Malay region, is the chief plant of the Guttiferae or Garcinia family grown for its edible fruit. As this tree and fruit is little known to the Western hemisphere, it may be of interest to this Congress to depart slightly from the subject of this paper, and establish a background by giving a short description of the tree and fruit, together with a few remarks relative to its establishment in the Western hemisphere.

The mangosteen is a small tree, rarely over thirty feet high, with deep green foliage which resembles that of the so-called rubber tree (*Ficus elastica*). The leaves are elliptic—oblong in form, acuminate at the tip, thick and leathery in texture, and six to ten inches long. The hermaphrodite flowers are two inches broad and are borne at the tips of the young branches.



I quote Dr. David Fairchild's description of the fruit:

"This delicious fruit is about the size of a mandarin orange, round and slightly flattened at each end, with a smooth, thick rind, rich red-purple in color, with here and there a bright, hardened drop of the yellow juice which marks some injury to the rind when it was young. As these mangosteens are sold in the Dutch East Indies, heaped up in fruit baskets, or made into long regular bundles with thin strips of braided bamboo, they are as strikingly handsome as anything of the kind could well be, but it is only when the fruit is opened that its real beauty is seen. The rind is thick and tough, and in order to get at the pulp inside, it requires a circular cut with a sharp knife to lift the top half like a cap, exposing the white segments, five, six, or seven in number, lying loose in the cup. The cut surface of the rind is of a moist delicate pink color and is studded with small yellow points formed by the drops of exuding juice. As one lifts out of this cup, one by one, the delicate segments, which are the size and shape of those of a mandarin orange, the light pink shades of the cup and the veins of white and yellow embedded in it are visible. The separate segments are between snow white and ivory in color, and are covered with a delicate network of fibers, and the side of each segment where it presses against its neighbor is translucent and slightly tinged with pale green. The texture of the mangosteen pulp much resembles that of a well-ripened plum, only it is so delicate that it melts in the mouth like a bit of ice cream. The flavor is quite indescribably delicious. There is nothing to mar the perfection of this fruit, unless it be that the juice from the rind forms an indelible stain on a white napkin. Even the seeds are partly or wholly lacking, and when present are very thin and small."

The mangosteen will thrive in many parts of the American tropics providing that consideration is given to its soil and moisture requirements. The earliest recorded introduction of the Mangosteen in tropical America took place in Trinidad between 1850 and 1860 from the greenhouses of the Royal Botanic Gardens at Kew, England. Since then successful introductions have been made into other parts of the West Indies as well as Central and South America. Probably the chief reasons for the extremely limited distribution of mangosteen trees lay first in the difficulty of transporting seeds long distances and secondly to the fact that young seedling are extremely difficult to grow.

Dr. David Fairchild was successful, during his travel in the Asiatic tropics in 1925-1926, in working out a method of packing mangosteen seeds which was superior to any method previously tried. The seeds were packed in very slightly dampened peat or coconut fiber and placed in

air-tight containers. We have recently been successful in getting good germination from seeds after three months storage in this manner.

Young mangosteen plants are exceptionally hard to raise. Good seeds germinate readily but a large percentage of the seedling refuse to grow after they are two or three months old and many of them die off during the first year. The difficulty has been attributed to an inherently weak root system. To eliminate this, grafting on a more vigorous species of *Garcinia* has been recommended, but in so far as I am aware, no satisfactory root stock has been found. Successful unions have been obtained between the Mangosteen and various other *Garcinias* but there seems to be a decided incongruity between the mangosteen and the root stocks we have tried. The growth of the buds or cions has been very slow and in all of our trials with *Garcinia tinctoria* and *Garcinia benthami* the plants died in less than two years after the stock was cut back and the mangosteen foliage was required to manufacture food for itself and the stock. Mangosteens grafted or budded on mangosteen stock grow very well but our experiments have not progressed far enough to tell at what age such trees may be expected to fruit. Naturally the only reasons for using mangosteen stock would be to hasten the time of fruiting or to propagate choice varieties.

In 1931, when our trees first fruited, at the age of six years from setting them out in the orchard (we have no record of how old the trees were when we received them), our chief desire was to work out a suitable method of propagating such seeds as we had available. Fortunately Dr. Wilson Popenoe visited our Gardens just as the seeds were beginning to germinate in seed flats, and suggested that we plant some of them out in well-fertilized nursery rows. Half of the seedlings were thus planted out in this manner just as the second pair of leaves were forming. Shade was supplied this nursery for the first year, at which time the seedlings averaged twelve inches in height, as compared with two and a half inches for the other half of the plants which were potted in quart cans. The loss of plants in the nursery row was also negligible and was certainly not any more than would be expected from setting out citrus seedlings.

In transplanting the seedlings to their permanent location in the orchard during the second year, it was noted that their root systems were formed deeply underground. We believe that the failure of the plants which were grown in pots was due to their inability to send down roots to the zone they normally would occupy.

Seedlings started in the nursery row and planted to their permanent places in the orchard when they were about two years old produced their first fruits when they were six years old. The secret of mangosteen



growing is to keep the plants growing vigorously from the time the seeds start germinating. The climate and soil are not as important as was formerly thought. If moisture is lacking it can be supplied by irrigation. Commercial fertilizers can likewise be furnished to make up any nutrient deficiency.

When possible, however, it would seem desirable to plant on land which has plenty of subsoil moisture, as there is no doubt that the trees want an abundance of moisture, but they also want perfect drainage.

Under our conditions in the Canal Zone few plants grow more luxuriantly and seem to be more at home than the mangosteen. No insect pest or plant disease here is known to menace seriously the trees or their fruits and thus there should be no difficulty in shipping them from one country to another. Last year we disseminated over 15,000 seeds to various parts of the American tropics and it is hoped that some day this "Queen of Fruits" will be as well known in the American tropics as apples and oranges in the temperate zone.

#### SOUTH AMERICAN LEAF SPOT DISEASE OF HEVEA

The South American Leaf Spot disease (*Dothidella Ulei* P. Henn) of Para rubber, *Hevea brasiliensis* was unknown in Panama prior to the time that the Goodyear Rubber Company started planting rubber in the vicinity of Gatun Lake in 1935. Although all of their planting material either came direct from their estates in the Philippines, where they do not have the South American Leaf Spot disease, or from nurseries at the Canal Zone Experiment Gardens, where no diseased trees were found up to 1939, the disease spread rapidly on the Goodyear All-Weather Estate on Gatun Lake and considerable time and energy has been expended trying to locate the source of infection.

In so far as is known the disease is not carried on seeds and does not attack any other trees than *Hevea brasiliensis*. None of these trees are found in a native state in Panama. The logical thing then would be to suppose that the disease had reached the Isthmus on introduced trees. This could easily have been the case as many trees have been introduced and planted in Panama as well as in the Zone townsites and at the Experiment Gardens. However, repeated inspection of these trees has failed to disclose any sign of the disease.

In 1931, Mr. F. C. Baker, representing the United States Department of Agriculture, brought several thousand seeds from Haiti and planted them in nursery beds at the old Las Cascadas Plantation near Summit. Some of these trees are now badly infected with the disease, although it was not present in this isolated plot when the trees were thoroughly examined in 1938.

In 1937 we transplanted a number of budded trees from nursery rows into their permanent location in a newly cleared area of the Gardens. These trees were free from disease when they were transplanted and when they were inspected in 1938, but a few of them were found to be infected in 1939.

Evidence would tend to indicate that the South American Leaf Spot disease is common in the forests of Panama and is not confined to the genus *Hevea* alone, as was formerly thought to be the case. The Spurge Family (*Euphorbiaceae*) is one of the largest families of tropical plants and is represented by at least twenty-five genera and numerous species in the Canal Zone alone. Until each of these species is thoroughly studied, we feel that they may be looked upon with suspicion as possible hosts for the South American Leaf Spot disease, *Dothidella ulei*.

#### REPORT OF A TRIP TO BOQUETE AND EL VOLCAN

Under authority issued by the Governor of The Panama Canal, in accordance with the recommendation of the Chief Quartermaster, the Director left Balboa by car on April 8, for an eighteen-day official trip to the Volcan and Boquete regions of Panama.

The main reasons for the trip were (1) to disseminate *Cinchona ledgeriana* seeds to reliable parties interested in experiment work; (2) to inspect former plants which had been sent to the Volcan and Boquete regions for trial; (3) to secure such propagating material as there was available which might be grown at the Experiment Gardens or be used to advantage in the new Army project; and (4) to assist or advise the farmers in any way possible with their many problems.

Packages of *Cinchona* seeds were left with six reliable finca owners in the Volcan region, and five in the Boquete region, at elevations ranging from approximately 3,500 feet to 6,000 feet. A copy of an extract from a report on the "*Cinchona* (Quinine) Industry in Java," by W. N. Sands, was given each person who received a package of seeds.

Not one of the 380 *Cinchona* trees which were received on December 2, 1938 from the United States Department of Agriculture and distributed among planters in Boquete and the Volcan regions of Panama, are in existence. Few of the little plants even withstood the first dry season. It is sincerely hoped that better results may be obtained from the 150,000 seeds which have just been distributed.

Mr. W. J. Wright has two beautiful *Macadamia* nut trees (*Macadamia ternifolia*) growing in his gardens in Boquete. These trees were sent to Mr. Wright several years ago from the Canal Zone Experiment Gardens. One of the trees was producing its first crop of nuts at the



time of this inspection, and besides having over two dozen nuts, which were three-fourths grown, the tree was flowering luxuriantly. As this is one of the most delicious of all nuts it is likely that it will be more extensively grown in the Boquete region. The one tree which was given to Mr. T. B. Monniche in 1934 has grown even better than the trees at Mr. Wright's, but it has not borne fruit yet. This is to be expected however, as Mr. Monniche's finca is over 1,000 feet above Boquete.

Much credit is due Mr. and Mrs. R. G. Lewis for the important scientific information they are securing. They are located on the bank of the Chiriqui Viejo River at approximately 6,000 feet elevation. Besides keeping accurate temperature and rainfall records, they are experimenting with fruits, vegetables, ornamentals, and forest trees. Among many other subtropical plants, they are growing several varieties of apples, pears, peaches, figs, and plums.

Mr. T. Howard, a former member of the Staff of the United States Department of Agriculture, lives with the Lewises and is very active in assisting them.

The work being done in the Volcan by the Lewises and Mr. Howard is very gratifying, and is especially welcome at this time, as practically all of the beautiful timber trees, oak, cedar, bambito, and other hardwood trees along the banks of the Chiriqui Viejo River, between Bambito and Cerra Punta, have been felled in an attempt to secure small plots of land upon which to plant white potatoes. The result is pathetic. Thousands of dollars worth of hardwood timber trees have been destroyed in order to grow a few hundred pounds of small white potatoes, which ordinarily would not even be harvested in real potato-growing regions. Much of the land is so steep that even "machete planting" is hazardous, and the good topsoil for which the Volcan was once noted, has been washed away, exposing coarse, sandy, infertile volcanic ash. Huge logs, which jam the river, are dislodged during storms to aid the already hastened erosion action of the river. A conservative estimate of the erosion damage done to this one valley during the past three years would be the equivalent of that which took place during the preceding century.

Practically all of the coffee fincas in the Volcan region have been abandoned, due to the devastating effect of the "Coffee Leaf Spot" disease, variously known under the scientific names of *Stilbum flavidum*, *Stilbella flavida*, *Spacrostible flavida*, and *Omphalia flavida*. This coffee disease was dealt with extensively by Mr. Higgins in the 1934 Annual Report of the Canal Zone Experiment Gardens, and thus it is not deemed necessary to make further mention of it.

The finca worked by Mr. Frank Mathews seems to be the only large coffee finca remaining in the whole Volcan region. The disease is not as





PLATE V



Tractor plowing newly cleared areas

severe in the Boquete region, and there is no evidence of fincas having been abandoned. In fact, this was an exceptionally good year for coffee growers as crops were good and the prices high.

The average farmer in Boquete seems to be more progressive and prosperous than his Volcan neighbors. Although coffee is the main crop of this region, potatoes, oranges, carrots, cabbages, onions and other vegetables are grown in quantities for export.

Boquete oranges, although rather insipid in flavor when fully ripe, are unexcelled in quality. Some fine orange orchards have been set out, and it should not be long before a noticeable number of Bahia or Washington Navel oranges from Boquete appear in the markets of Panama City. Excellent white potatoes, onions, carrots, cabbages and other vegetables are often grown to good advantage between the rows of oranges. As ample commercial fertilizer is used, the soil is enriched rather than exhausted by this practice. Water is plentiful in Boquete and it is used lavishly in the gardens during the dry season.

The cut-flower business is also worthy of note as many of the flowers sold by florists in Panama City are brought in from Boquete by plane. The Ruiz Flower Gardens have a Shaw Du-All tractor and equipment. This is probably the only one of its kind in Panama. Besides their flower gardens, which occupy several acres, they plow and cultivate a large plot for potatoes and onions and maintain a small citrus nursery. All this is accomplished, if not made entirely possible, with the aid of the small walking tractor.

Propagating material of twenty species of plants was brought down from the Chiriqui Province for trial on the Isthmus. These included seeds of native species of Avocados, which may be of value as root-stock for choicer varieties of Avocados; three species of ornamental palms; six species of orchids; two ferns; three species of *Philodendrons*; and plants of violets, figs, and geraniums. Seeds of *Aristolochia grandiflora* were also secured.

#### NEW EQUIPMENT

On July 19, 1939 we received a new 20-horsepower Oliver tractor and a Chase two-disc plow and harrow. This new equipment has already more than paid for itself in service rendered and has made it possible to clear and plow over forty acres of jungle land. It was previously considered impracticable by some to plow land in Panama and the Canal Zone, but we have proved conclusively that it is practicable and highly advantageous to work the soil thoroughly. (See Plate V.)



The job of grading the new roads was greatly facilitated by the use of the new Fresno tractor scraper. The soil was softened with the tractor drawn plow, and uneven areas were leveled off with the scraper attached to the tractor.

The new Kemp soil shredder was proved to be equal to the demands made upon it. Rough compost and soil run through the machine are thoroughly mixed and pulverized in one operation.

Our old Roovers embossing machine, which was used for embossing plant names on zinc ribbon, was replaced with a new machine of the same make.

#### ROADS AND PATHS

Approximately a mile and a quarter of new gravel roads were constructed in the newly developed nursery area during the fiscal year just ended. It is expected that eventually these roads will be macadamized, and thus made more permanent. In the meantime, however, they will serve as a means of getting into any portion of the new nurseries, even in the worst weather.

All of the paths and macadamized roads in the Gardens were oiled. The main concrete road leading through the Gardens was widened four feet, thus allowing room for cars to pass. There is also ample room for cars to park near the lily ponds without obstructing traffic in these areas.

#### BUILDINGS

The rebuilding of the large barn No. 36 on the portion of land formerly leased by Mr. Hele, was started by the Constructing Quartermaster's force on June 10th. The building is 50 x 75 feet, and will be used for a potting shed, storage space for cans and shipping crates, as well as a shelter for the tractor and other farm machinery. (See Plate VI.)

The Gardens' forces are undertaking the rebuilding of an old storage shed and stable which had become so thoroughly rotted that it was no longer serviceable.

Minor repairs were made to the wooden benches in the greenhouses.

#### BENCHES

The Gardens in the past have lacked benches and picnic areas where visitors could stop to eat their lunches, or sit and rest as they wandered over the grounds. The picnic problem was pretty well taken care of last year with the establishment of four areas with tables, benches, and fireplaces. This year, twelve trial benches were placed in shady locations near walks or drives, and if these arouse anywhere near the favorable

PLATE VI—New Barn



FIGURE 1—Front view



FIGURE 11—End view









Two views of lily pond showing concrete walls

comment that the picnic areas have, then additional benches will be secured.

The benches have concrete ends and wooden seats and backs. Besides being comfortable and attractive, the benches will be relatively easy to keep free of termites and will be economical to maintain.

### LILY POND

One of the many attractions for visitors is the lily ponds with their brightly colored tropical water lilies. Gorgeous green and blue dragonflies with large red eyes, fly to and fro over the ponds, and alert Jacanas (*Jacana nigra*) walk jerkily from lily pad to lily pad feeding on small fishes and water lily seeds.

One of the ponds, which is flanked with Mangosteen trees (*Garcinia mangostana*) on one side, and graceful palms and Chinese Litchi trees (*Litchi chinensis*) on the other side, was reworked this year. Concrete walls and bottom were added, and a collection of 15 varieties of water lilies were planted in well-fertilized soil in barrels. Two benches have been conveniently placed in a shady nook near the pond, so that visitors may sit and admire the lilies, as well as find a cool retreat among pleasant surroundings. Plans for making other similar retreats are contemplated. (See Plates VII and VIII.)

### GAMBOA FLOWER SHOW

The second Gamboa Flower Show, sponsored by the Gamboa Woman's Club, was held on March 13th in the Gamboa Gymnasium. Many outstanding exhibits of potted plants were on display. These were all grown by local amateurs. Competition was also keen in the different classes of amateur floral arrangements, although the commercial exhibits were not on a par with those in last year's show.

The Gardens staff assisted in arranging an exhibit of palms and house plants, as well as acting on the judging committee.

### FINANCIAL STATEMENT

During the past fiscal year, the activities of the Experiment Gardens have greatly increased. In order to present a more understandable picture of the financial conditions of the Gardens, it is proposed to divide the statement into two correlated parts, namely Gardens Activities, and Nursery Activities. The financial statement for the period of July 1, 1939 to June 30, 1940, follows:



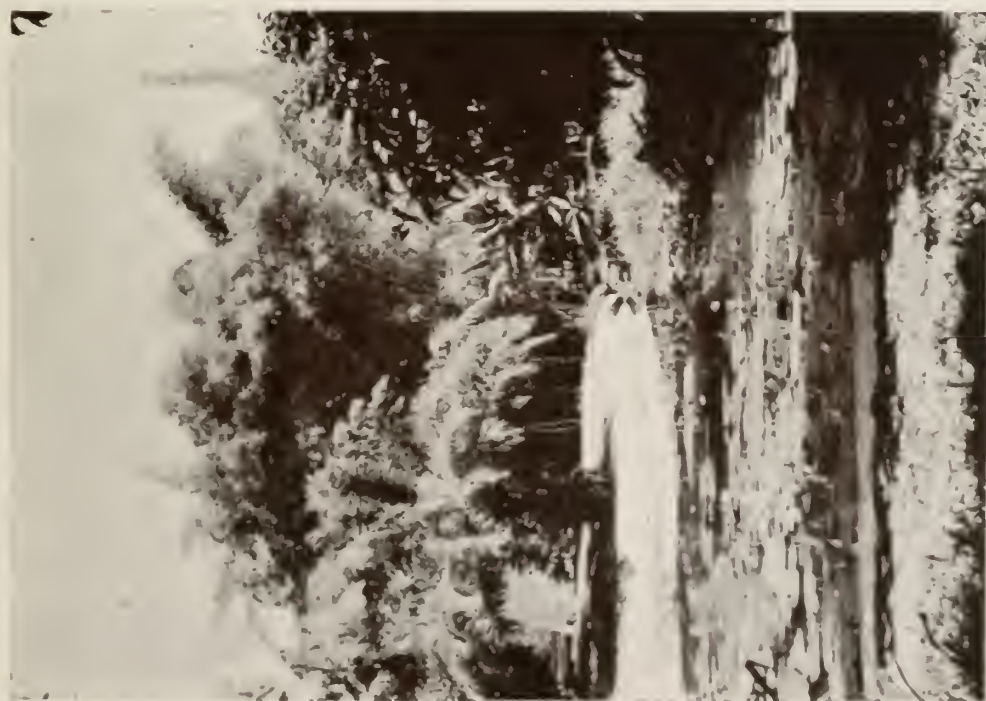
	Gardens Activities		Nursery Activities	
	Revenues	Expenses	Revenues	Expenses
Revenues—				
Agricultural licenses (net) .....	*\$6,000.00	-----	-----	-----
Appropriations .....	15,000.00	-----	-----	-----
Gardens services .....	*41,575.00	-----	-----	-----
Nursery sales .....	-----	-----	*\$9,000.00	-----
Total revenues .....	62,575.00	-----	9,000.00	-----
Expenses—				
Total gardens expenses .....	-----	*\$57,325.00	-----	-----
Total nursery expenses .....	-----	-----	-----	*\$11,960.00
Total expenses .....	-----	57,325.00	-----	11,960.00
Total surplus or deficit .....	4,150.00	-----	-----	(2,960.00)
Summary—				
Gardens activities surplus .....			\$4,150.00	
Nursery activities deficit .....			2,960.00	
Total gardens surplus .....			1,190.00	

NOTE.—As a complete return on revenues and expenses for the month of June 1940, have not been received at the time of the writing of this report, these statements indicated by (\*) have been estimated.

As shown in the above statement, the Nursery revenues derived from plant sales is considerably below the expenses incurred. There are two reasons for this deficit. First, the past fiscal year has been a comparatively poor sales year, due materially to the small landscape planting program, and second, the Nursery unit was forced to expand its nursery areas in order to have room to grow planting material for the new landscape program. This expansion naturally incurred considerable expense, for which no returns can be expected until next fiscal year.

○

PLATE VIII



Two views of lily pond No. 2













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